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PLASMA CUTTING TORCH WITH SYSTEM FOR THE IDENTIFICATION OF THE HEAD, THE ELECTRODE OR THE TUYERE

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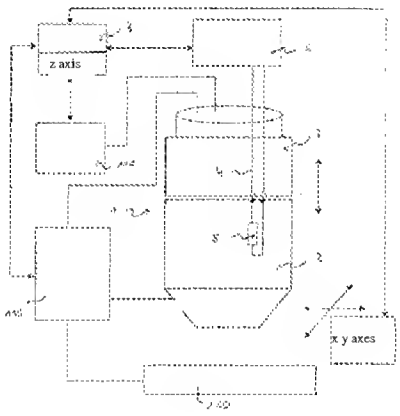
The invention relates to an electric arc work torch (1), particularly a plasma cutting torch which comprises a torch body (3) comprising means to supply an electrical current and at least one fluid duct; a torch head (2) comprising electrode carrier means that are capable of receiving an electrode (20) and tuyere carrier means (12) that are capable of receiving a tuyere (22). The torch optionally comprises assembly/disassembly means making it possible to connect the torch head (2) to the torch body (3) or to disconnect said torch head from said torch body. According to the invention, the torch head (2), the electrode (20) and/or the tuyere (22) or any other consumable part are equipped with an identification element (5) from which a signal having a preestablished and identified specific value, for example, a voltage or amperage value, can be extracted or determined.

FIG. 1



Description

[0001]

The present invention concerns an electrical arc work torch, particularly a plasma cutting torch, particularly a torch with a head that can be disconnected, where said torch is equipped with a system for the recognition and identification of the torch head or wearing parts that equip said torch head.

[0002]

Today, there are two families of plasma cutting torches, namely, on the one hand, "blown plasma cutting torches" which are used for marking, for the projection of surface coatings, for heating (in a high furnace) and similar processes and, on the other hand, "transferred plasma cutting torches" which are used for welding, cutting and similar operations.

[0003]

In the field of automatic plasma cutting, where the plasma cutting torch is arranged on a cutting machine, two types of torches can be used, namely torches of the monoblock type or torches in two parts, namely a nose or head that can be disconnected.

[0004]

A monoblock torch usually comprises a complete torch assembly which is equipped with its bundle of cables and ducts of various types.

[0005]

More specifically, such an assembly usually comprises an electrode carrier, which functions as a cathode, and which is connected through the intermediary of an insulating material to a tuyere carrier, which functions as the anode and carries an ejection tuyere for the plasma arc.

[0006]

The electrode carrier and the tuyere carrier are connected by electrical cables to one or more electrical current generators.

[0007]

During their operation, the electrode carrier and the tuyere carrier have to be cooled to prevent them from deteriorating too rapidly and, for this purpose, they are connected by ducts to a source of cooling fluid, generally water. The assembly of the cables and tubes that feed the torch is called a bundle.

[0008]

In addition, the torch comprises active parts, notably an immersion tube which transports the cooling fluid as close as possible to the active end of the torch; an electrode which is formed from a special material, that is an emissive insert made of tungsten, zirconium, hafnium or a similar material, which is chosen as a function of, for example, the gas which is used, the amperage of the current or the thickness to be cut; a special gas diffuser as a function of the gas used or the range of the current amperage; a tuyere which is specific for each gas and amperage; an external protecting cover which forms a sleeve around the tuyere and functions, in addition, as a cooling chamber; and a nut part whose function is to keep the cover and the tuyere in place on

the active end of the torch; this nut part can be replaced by a water vortex device or by a device with gaseous "double flow."

[0009]

The architecture and the operation of such torches of the monoblock type have been described notably in the following documents: EP-A-144267, EP-A-410875, EP-A-772957, EP-A-902606, EP-A-810052, EP-A-845929, EP-A-790756, EP-A-196612, WO-A-89/11941, US-A-4,521,666, US-A-4,059,743, US-A-4,163,891 and US-A-5,591,357.

[0010]

Moreover, a torch in two parts, also called a torch with detachable head or nose, generally comprises a torch body or base comprising the bundle of cables and fluid ducts (cooling water and gas), as explained above, and it is also capable of receiving one or more different torch heads, where the torch head comprises the active parts of the torch, namely the electrode, the tuyere etc.

[0011]

The architecture and the operation of such torches with detachable head or nose are described notably in the following documents: EP-A-599709, EP-A-872300, EP-A-801882 and EP-A-941018.

[0012]

In the case of a torch with detachable head or nose, a torch head is generally devoted to a particular process and/or a limited amperage range.

[0013]

In other words, each torch head is equipped with active parts, which have variable characteristics and which are a function of the process to be carried out or the amperage of the current that supplies the torch and is used to generate the plasma arc.

[0014]

Thus, the method to be carried out can vary and must be chosen as a function of the nature of the gas or gas mixture to be used, the type of gas distribution (simple distribution, turbulent distribution, double flow, post water distribution...), as a function of the nature of the material to be cut (steel, stainless steel, aluminum, ...)and its thickness, and as a function of the suitability of the cut part to be welded or other requirements.

[0015]

Usually, the principal gases or gas mixtures that can be used for plasma cutting are nitrogen, oxygen, compressed air, or argon/hydrogen, or nitrogen/hydrogen mixtures.

[0016]

In addition, it is known that the current amperage must be chosen as a function of the thickness of the material to be cut; thus, the thicker the material is, the higher the amperage to be used must be.

[0017]

However, one must also take into account the desired type of cut: cut of high quality or simple cut for separation.

[0018]

Usually, the amperage range used can range from 10 to several thousand amps.

[0019]

Thus, there are numerous types of parts with different wear behavior and consequently torches that can be adapted to the different amperages can be used.

[0020]

In the case of a monoblock torch, the presence of the torch, that is its operation, can be detected with the help of a direct connection between two prongs at the level of a connector of the bundle by means of a simple electrical installation which detects the presence of the connection.

[0021]

Nevertheless, because each monoblock torch is intended for one cutting process and/or one amperage range, when the operator or person carrying out the cutting wishes to first cut a first material, for example, a sheet of stainless steel having a thickness of 70 mm, and then a second material, for example, a sheet of aluminum having a thickness of 5 mm, he must:

- either change the torch he/she uses during the cutting of the first material and replace it with a torch that is adapted to the cutting of the second material, which requires the disconnection of the bundle from the current generator, the disconnection of the bundle from the machine, the removal of the torch from its support or the disconnection of the torch and its support, before carrying out the reverse operations to install the new torch on the support;
- or disconnect all the parts of the active part of the torch (electrode, tuyere...) after having cut the first material and replace them with active parts which are adapted to the cutting of the second material.

[0022]

It is easy to understand that, in either case, these operations are not very practical, they result in a non-negligible loss of time and they can lead to errors in the assembly.

[0023]

To overcome these problems, it is appropriate to use a torch with a detachable and interchangeable nose or head.

[0024]

Thus, the operator can prepare the detachable second head with the suitable active parts which he/she will need to cut the second material, while the other torch head is being used, that is during the cutting of the first material.

[0025]

Then, he/she will need only a few seconds to change the torch head and cut the second material, given that, in this case, the torch body which is attached to the machine or to the structure support remains the same and thus does not have to be replaced.

[0026]

However, a problem arises with torches with detachable heads, namely the large number of potential combinations of torch bodies and torch heads, which results in a correspondingly high number of possible sources of errors for the operator.

[0027]

In other words, the operator should not be able to give inappropriate amperage regulation commands with the selected head, because such inappropriate regulations result in the deterioration of the torch head or in a cut of poor quality.

[0028]

For example, if active parts (electrodes, tuyeres...) that are provided to withstand an amperage of 30 A are used with a current of 300 A, said parts will be destroyed by melting, and this will generally result in the destruction of at least a part of the torch body.

[0029]

Moreover, the same applies to the fluids that are used.

[0030]

For example, an electrode made of tungsten, which is intended to operate under nitrogen, will not work for a long time if the gas is oxygen or another oxidizing gas.

[0031]

Such sudden destructions of the elements of the torch generate non-negligible costs in terms of time and/or money, which are not acceptable from an industrial point of view.

[0032]

To solve this problem, the simplest solution would be to put a color identifier or another mark on each torch head.

[0033]

However, this solution is not ideal because, over time and as a result of soiling due to the smoke emissions, the different torch heads can be mistaken for each other because the paint or ink may be partially erased, requiring a sufficiently powerful lighting to be able to visually distinguish a color or a mark, or engraved marks can be filled with dirt and become illegible, etc.

[0034]

Another solution would consist in using a photoelectric sensor which makes it possible to detect the presence of the torch head on the torch body.

[0035]

However, again, the solution is not ideal, because the information that can be collected is then of the binary type, that is 0 or 1, which does not make it possible to distinguish different torch heads from each other.

[0036]

Moreover, very similar problems arise when one must recognize a specific wearing part, such as an electrode or a tuyere which has been mounted on the head of a plasma cutting torch, regardless of whether the latter can or cannot be disconnected from the torch body.

[0037]

Indeed, an analogous problem arises with the wearing parts and are intended for electrical arc torches, namely there is a large number of types of tuyeres and electrodes, each presenting specific and variable characteristics depending on the process to be carried out, for example, as mentioned above, an electrode with a tungsten insert, which is intended for operation under nitrogen, will not work for a long time if the gas used during the cutting is oxygen or another oxidizing gas, and such unintended destructions of these wearing parts generate non-negligible costs in terms of time and/or money, which are not acceptable from the industrial point of view.

[0038]

Again, the large diversity of existing wearing parts generates numerous potential errors for the operator.

[0039]

Consequently, the operator should not be able to give inappropriate commands for regulating the amperage for a selected part that is susceptible to wear, because such inappropriate commands generate a deterioration of the part that is susceptible to wear or of the torch head, and result thus in a cut of poor quality.

[0040]

The purpose of the present invention is therefore to solve the above-mentioned problem, which arises with an electrical arc work torch, notably torches that have a detachable head, particularly plasma cutting torches, where the torch is equipped with a system that makes it possible to avoid or minimize any error in the mounting of the torch head on the torch body or any error in an erroneous or poorly suited choice of the wearing parts for equipping the torch head, by warning the operator that the torch head or the wearing part, which has been mounted by error, does not correspond to the selected operating conditions that have to be achieved.

[0041]

In other words, the purpose of the invention is to propose a torch which is equipped with a system that makes it possible to verify that the torch head and/or the wearing parts, which are present on the torch, are compatible with the selected process and with the range of current amperages to be applied.

[0042]

The solution of the present invention then is an electrical arc work torch, particularly a plasma cutting torch, which comprises

- a torch body comprising means to supply an electrical current and at least one fluid duct,

- a torch head comprising electrode carrier means that can receive an electrode and tuyere carrier means that can receive a tuyere, and

- assembly/disassembly means that make it possible to connect the torch head to the torch body and/or to disconnect said torch head from said torch body,

characterized in that the torch head comprises, in addition, an identification element from which a signal having a preestablished and identifiable specific value can be extracted or determined.

[0043]

In addition, the invention also relates to an electrical arc work torch, particularly a plasma cutting torch, which comprises a torch body comprising means to supply an electrical current and at least one fluid duct, a torch head comprising electrode carrier means that can receive an electrode, and tuyere carrier means that can receive a tuyere, characterized in that the electrode, which is carried by the electrode carrier means, and/or the tuyere which is carried by the tuyere carrier means comprise(s) an identification element from which a signal having a preestablished and identifiable value can be extracted or determined.

[0044]

According to another aspect, the invention also concerns an electrical arc work torch, particularly a plasma cutting torch, which comprises a torch body comprising means for supplying an electrical current and at least one fluid duct, and a torch head, where the torch head and/or the torch body comprise means for carrying a consumable part, which means can receive at least one consumable part chosen from tuyeres, electrodes, cartridge assemblies that combine a tuyere and an electrode, immersion tubes, and gas or water diffusers, characterized in that at least one of said consumable parts comprises an identification element from which a signal having a preestablished and identifiable fixed value can be extracted or determined.

[0045]

In the context of the present invention, the term "signal" is considered to be synonymous with the term "data;" accordingly, either one of these terms will be used interchangeably.

[0046]

Depending on the case, the torch of the invention can comprise one or more of the following characteristics:

- the torch body comprises signal transmission means which make it possible to send the signal originating from the identification element through at least a part of said torch body and, preferably, to a signal processing unit.

- the identification element is chosen from resistances, capacitors, diodes (such as the signal diodes or Zener diodes), coils, reflecting blanks, systems that use the principle of infrared or radio frequency remote controls, "chip card" elements and magnetic or magnetized elements, or a combination of several of these elements, for example, an RLC element which combines a resistance, a coil and a capacitor, where it is preferred to choose the identification element from the resistances.

- the signal having a specific value is at least an amperage, voltage, capacity, frequency, light, infrared or radio frequency signal, and preferably an amperage or voltage signal,

- the signal processing unit is connected to a control director, preferably the control director controls at least one current source, at least one fluid source and/or means for displacing the torch along at least one x, y and/or z axis.

[0047]

According to another aspect, the invention also relates to a plasma cutting torch head comprising electrode carrier means that can receive an electrode and tuyere carrier means that can receive a tuyere, characterized in that it comprises, in addition, an identification element from which a signal having a preestablished and identifiable specific value can be extracted or determined.

[0048]

Depending on the case, the plasma cutting torch head of the invention can comprise one or more of the following characteristics:

- the identification element is chosen from resistances, capacitors, diodes, coils, reflecting blanks, systems that use the principle of infrared or radio frequency remote controls, magnetic or magnetized elements, and chip card elements and their combinations, where it is preferred to choose the identification element from resistances.

[0049]

According to another aspect, the invention relates to a method for controlling an electrical arc work torch, particularly a plasma cutting torch, which comprises a torch head according to the invention, which is fixed to a torch body, in which method one carries out the following steps:

(a) determination and/or extraction of a signal having a preestablished specific value from said identification element;

(b) processing of said signal having a specific value, which signal was determined or extracted in step (a) by comparing the value of said signal with at least one reference or nominal value, and

(c) control of the power supply of the torch with electrical current and with at least one fluid as a function of the result of the comparison made in step (b).

[0050]

Depending on the case, the method of the invention can comprise one or more of the following characteristics:

- the signal having a specific value is at least an amperage, voltage, capacitance, magnetic, frequency, light, infrared or radio frequency signal, and preferably an amperage or voltage signal.

- the control of the supply of the torch with electrical current and fluid comprises at least one of the following steps:

(i) authorizing the supply of the torch with electrical current and with fluid in such a manner that an operation of working with the arc is started, if the comparison made in step (b) shows that the value of the determined specific signal is equal to or close to the reference or nominal value; and

(ii) prohibiting the supply of the torch with electrical current and with fluid in such a manner that the start of an operation of working with the arc is prevented, if the comparison made in step (b) shows that the value of the determined specific signal is different from the reference or nominal value.

[0051]

The invention also relates to a tuyere or an electrode for an electrical arc work torch, particularly a plasma cutting torch, which comprises an identification element as mentioned above.

[0052]

The invention also relates to a method for plasma cutting at least one metal part, in which one uses a plasma cutting torch, a plasma cutting torch head and/or in which one uses a control method according to the invention to control a plasma cutting torch.

[0053]

In other words, the solution that is contributed by the present invention is based essentially on the incorporation in the torch head of an identification system that can warn the operator immediately and effectively if the torch head that has been placed is not compatible with the selected process and/or with the current amperage and/or with another operating parameter.

[0054]

The invention will now be described in greater detail with the help of the figures in the appendix, which are given as nonlimiting illustrations.

[0055]

Figure 1 is a diagram of the principle of operation of a torch with detachable head according to the present invention.

[0056]

The plasma cutting torch 1, entirely analogously to the one described, for example, in the document EP-A-599709, which is incorporated here by reference, comprises a torch body or base 3, on which the torch head 2, equipped with the identification system according to the invention, is mounted. The torch 1 is supplied with fluids originating from fluid sources 100, notably a plasmagenic gas and cooling water, and it is also supplied with an electrical current originating from a current generator 110, which is connected, on the one hand, to the part to be cut 120 and, on the other hand, to the electrode of the torch 1 and the tuyere.

[0057]

The identification system of the invention consists of an identification element 5 and signal transmission means 4 which connect this identification element 5 to a signal processing unit 6, which itself communicates with a control director 8 of the torch, thus making it possible to issue or not issue commands relating to a displacement of the torch 1 along the z axis.

[0058]

The identification element 5, which is included in the head 2 of the torch 1 is, for example, a resistance, a capacitor or a coil having a known determined value for each torch nose or head 2. One can also consider using other types of identification elements 5, such as, notably, a reflecting blank, a system which uses the principle of infrared or radio frequency remote controls, a chip card element, or a magnetic or magnetized element or their combinations.

[0059]

The term "chip card element" denotes the active part of the card, that is the integrated circuit or "chip," which is encapsulated in the plastic that is used as support. There are different types, for example, a first type with a visible connector, such as the one used in bank payment cards or similar devices, which have two operating modes, namely the reading of the magnetic strip, which is located on one of the faces of the card, and/or the writing of data recorded in the memory; a second type, such as access badges, which optionally have a remote reading system, for example, by a radio link; in this case, an antenna is associated with the chip used for the electrical power supply and for the transfer of digital data.

[0060]

Given that the identification element 5 can assume different values, it is possible to distinguish in this manner a large number of different torch heads 2 from each other, provided that each torch head 2 is equipped with an identification element 5 that has a preestablished and identifiable specific value.

[0061]

This identification element 5 is connected to a signal processing unit 6 which makes it possible to instruct the operator, if he/she made an incorrect choice, to verify the presence of the required fluids, to detect the presence of the torch head 2 which is appropriate for the process to be used, and thus to authorize or not authorize the performance of the cutting process. The signal processing unit 6 is managed by a control director 8, whose role is to supervise all the components which are necessary for the proper course of the cutting operation.

[0062]

The signal is processed by measuring, for example:

- a current or a voltage, if one uses a resistance which is powered by a fixed voltage or current source, respectively, or
- a capacitance, if one uses a capacitor,
- a frequency, if one uses a coil,
- a light wave, if one uses a reflector,
- an infrared or radio frequency receptor, and
- another device, such as a chip card reader.

[0063]

The measurement is then processed, for example, by means of an analog/digital converter of a type which is appropriate for the signal.

[0064]

The software of the control director 8 can alert the operator, in case of an error in the choice of the torch head 2, as shown diagrammatically in the flow charts of Figures 2 and 3.

[0065]

For example, if the operator wants to cut out a piece of a carbon steel sheet having a thickness of 4 mm, he consults a list or table of correspondences, which is supplied by the builder, and which indicates to the operator to use the process under dry oxygen at 60 A, as well as the types of active parts to be used.

[0066]

The operator thus equips a second torch head with those active parts while cutting, for example, a stainless steel sheet having a thickness of 10 mm with a process at 120 A that uses nitrogen and a turbulent water flow, with a first torch head which presents different characteristics.

[0067]

Once the work piece is finished, he/she replaces the first torch head with the second torch head, then he/she programs 60 A and changes the cutting speed, as specified in the list before launching the execution program.

[0068]

In the case of a poor choice of a head or a program, which is not suitable for the chosen torch head, the operator will be immediately warned by the identification system of the invention.

[0069]

It is preferred to use an element 5 of the resistive type (resistance etc.), as the identification system which is mounted on the torch with detachable head, because such an element is simple to use, inexpensive, reliable and not sensitive to the interferences encountered in an industrial environment.

Example of the differentiation with 12 combinations

[0070]

Using a constant current source of 20 mA, and a desired 1 V discrimination to prevent confusions, the resistance values will be between 50 and 600 Ω with an increment of 50 Ω to measure a voltage from 1 to 12 V, respectively, with an increment of 1 V, where the power of the resistance is 1/4 Watt.

[0071]

According to Ohm's law, $U = RI$, and since the current is constant, the voltage is directly proportional to the value of the resistance.

[0072]

It is then sufficient to list in a table of correspondences, opposite each voltage value, an amperage limit and a process which, consequently, imposes fluids (gas, turbulent water, double flow...).

[0073]

Table 1 below shows an example of the possibilities.

Table 1

CODING			IDENTIFICATION	
Amperage (in mA)	Resistance (in Ω)	Voltage (in V)	Cutting amperage (in A)	Process (gas)
20	50	1	≤ 90	Ar/H_2
20	100	2	≤ 90	O_2
20	150	3	≤ 90	N_2
20	200	4	≤ 90	N_2 + WV
20	250	5	≤ 90	O_2 + DF
20	300	6	≤ 90	Ar/H_2 + DF
20	350	7	from 120 to 150	Ar/H_2
20	400	8	from 120 to 150	O_2
20	450	9	from 120 to 150	N_2
20	500	10	from 120 to 150	N_2 + WV
20	550	11	from 120 to 150	O_2 + DF
20	600	12	from 120 to 150	Ar/H_2 + DF
WV: Water "vortex" - DF: double flow				

[0074]

As detailed in Figure 6, the electrical connections of the identification element 5 can be ensured at the level of the torch head 2 by a plug-in connector 15 of the male jack type having a diameter of 3.5 mm and, as represented in Figure 7, in the base 3 by a plug-in connector 16 of the female jack type, which makes it possible to easily couple the torch head 2 to the base 3 by a simple movement from the bottom up, because the rotation position is already imposed by the other connections (plasma gas, tuyere connection, controls of the jack, ...).

[0075]

As shown in Figure 1, two electrical conductors are sufficient to connect the base 2 to the processing unit as part of the bundle. However, in other cases, a single electrical conductor may be sufficient, while in other cases more than two conductors will be necessary.

[0076]

Figures 4 and 5 represent potential industrial versions of the torch heads 2 according to the invention, which are mounted, respectively, in a state without active parts and/or wearing parts (Figure 4) and in a state where they are equipped with such wearing parts (Figure 5), notably a tuyere 22 and an electrode 20; these torch heads 2 can be mounted on the base 3 of Figure 7.

[0077]

The torch head 2 comprises electrode carrier means 10 that can receive, for example, by screwing, an electrode 20 that is equipped with an emissive insert 21, and tuyere carrier means 12 that can receive and hold, for example, again by screwing, the tuyere 22 which is perforated with an axial ejection orifice 23 for the plasma jet.

[0078]

The assembly/disassembly means, comprising a ball cage 18 and an axially movable external part 19, which works in cooperation with said ball cage 18, as explained in EP-A-599709, make it possible to easily and rapidly connect the torch head 2 to the torch body 3 and/or disconnect said torch head from said torch body.

[0079]

According to the invention, the identification element 5 is carried by the torch head 2 and, in this case, a resistance, from which a signal having a preestablished and identifiable specific value can be extracted or determined, namely an amperage or voltage signal.

[0080]

Although the above embodiment examples concern only a system for the identification of the torch head of a plasma cutting torch with detachable head, this identification system, in the strict meaning of the word, can also be applied to the identification of wearing parts or consumable parts for an electrical arc torch, such as the tuyeres, the electrodes, a "cartridge" assembly comprising a tuyere and an electrode, as described in the document EP-A-326445, the immersion tube or the gas diffuser for a torch, or the additional devices that can be used to equip an arc torch, such as a device for generating a water vortex, for example, a water diffuser, or a double flow system with a second tuyere which is located downstream of the first tuyere, given that all these devices each include a body and one or more detachable parts, and because it is therefore necessary to identify the presence of each device, in general, and of each one of the active parts.

Claims

1. Electrical arc work torch (1), particularly a plasma cutting torch, which comprises:

- a torch body (3) comprising means for supplying an electrical current and at least one fluid duct,
- a torch head (2) comprising electrode carrier means (10) that can receive an electrode (20) and tuyere carrier means (12) that can receive a tuyere (22), and
- assembly/disassembly means which make it possible to connect the torch head (2) to the torch body (3) and/or to disconnect said torch head from said torch body,

characterized in that the torch head (2) comprises, in addition, an identification element (5) from which a signal having a preestablished and identifiable specific value can be extracted or determined.

2. Electrical arc work torch (1), particularly a plasma cutting torch, which comprises a torch body (3) comprising means for supplying an electrical current and at least one fluid duct, and a torch head (2), where the torch head (2) and/or the torch body (3) comprise(s) means for carrying a consumable part, which are capable of receiving at least one consumable part chosen from tuyeres (22), electrodes (20), cartridge assemblies combining a tuyere and an electrode, the immersion tubes, and gas or water diffusers, characterized in that at least one of said consumable

parts comprises an identification element (5) from which a signal having a preestablished and identifiable specific value can be extracted or determined.

3. Electrical arc work torch (1), particularly a plasma cutting torch, which comprises a torch body (3) comprising means for supplying an electrical current and at least one fluid duct, and a torch head (2) comprising electrode carrier means (10) that can receive an electrode (20) and tuyere carrier means (12) that can receive a tuyere (22), characterized in that the electrode (20), which is carried by the electrode carrier means (10) and/or the tuyere (22), which is carried by the tuyere carrier means (12) comprise(s) an identification element (5) from which a signal having a preestablished and identifiable specific value can be extracted or determined.

4. Torch according to one of Claims 1-3, characterized in that the torch body (3) comprises signal transmission means (4) which make it possible to send the signal originating from the identification element (5) through at least a part of said torch body (3) and, preferably, to a signal processing unit (6).

5. Torch according to one of Claims 1-4, characterized in that the identification element (5) is chosen from resistances, capacitors, coils, diodes, reflecting blanks, systems which use the principle of infrared or radio frequency remote controls, chip card elements, magnetic or magnetized elements, and combinations of several of these elements, where the identification element (5) is preferably chosen from the resistances.

6. Torch according to one of Claims 1-5, characterized in that the signal which has a specific value is at least an amperage, voltage, capacitance, frequency, light, infrared or radio frequency signal, or a magnetic signal, preferably an amperage or voltage signal.

7. Torch according to one of Claims 1-6, characterized in that the signal processing unit (6) is connected to a control director (8), preferably the control director (8) controls at least one power source (110), at least one fluid source (100) and/or means for the displacement of the torch (1) along at least one axis x, y and/or z.

8. Torch according to Claim 1, characterized in that it comprises assembly/disassembly means which make it possible to connect the torch head (2) to the torch body (3) and/or to disconnect said torch head from said torch body.

9. Plasma cutting torch head (2), which comprises electrode carrier means (10) that can receive an electrode (20) and tuyere carrier means (12) that can receive a tuyere (12), characterized in that it comprises, in addition, an identification element (5) from which a signal having a preestablished and identifiable specific value can be extracted or determined.

10. Torch head (2) according to Claim 9, characterized in that the identification element (5) is chosen from resistances, diodes, capacitors, coils, reflecting blanks, systems which use the principle of infrared or radio frequency remote controls, magnetic or magnetized elements, chip card elements, and their combinations, where the identification element (5) is preferably chosen from the resistances.

11. Tuyere (22) for an electrical arc work torch (1), particularly a plasma cutting torch, which comprises an identification element (5) from which a signal having a preestablished and identifiable specific value can be extracted or determined, where the identification element (5) is preferably chosen from resistances, diodes, capacitors, coils, reflecting blanks, the systems which use the principle of infrared or radio frequency remote controls, magnetic or magnetized elements, chip card elements, and their combinations.

12. Electrode (20) for an electrical arc work torch (1), particularly a plasma cutting torch, which comprises an identification element (5) from which a signal having a preestablished and identifiable specific value can be extracted or determined, where the identification element (5) is

preferably chosen from resistances, diodes, capacitors, coils, reflecting blanks, systems which use the principle of infrared or radio frequency remote controls, magnetic or magnetized elements, chip card elements, and their combinations.

13. Method for the control of an electrical arc work torch (1), particularly a plasma cutting torch, which comprises a torch (1) according to one of Claims 1-3, in which one proceeds in the following steps:

(a) determination and/or extraction of a signal having a preestablished specific value from said identification element (5);

(b) processing of said signal having a specific value, which signal was determined or extracted in step (a) by comparing the value of said signal with at least one reference or nominal value, and

(c) control of the supply of the torch (1) with electrical current and with at least one fluid as a function of the result of the comparison made in step (b).

14. Control method according to Claim 13, characterized in that the signal having a specific value is at least an amperage, voltage, capacitance, frequency, magnetic, light, infrared or radio frequency signal, preferably an amperage or voltage signal.

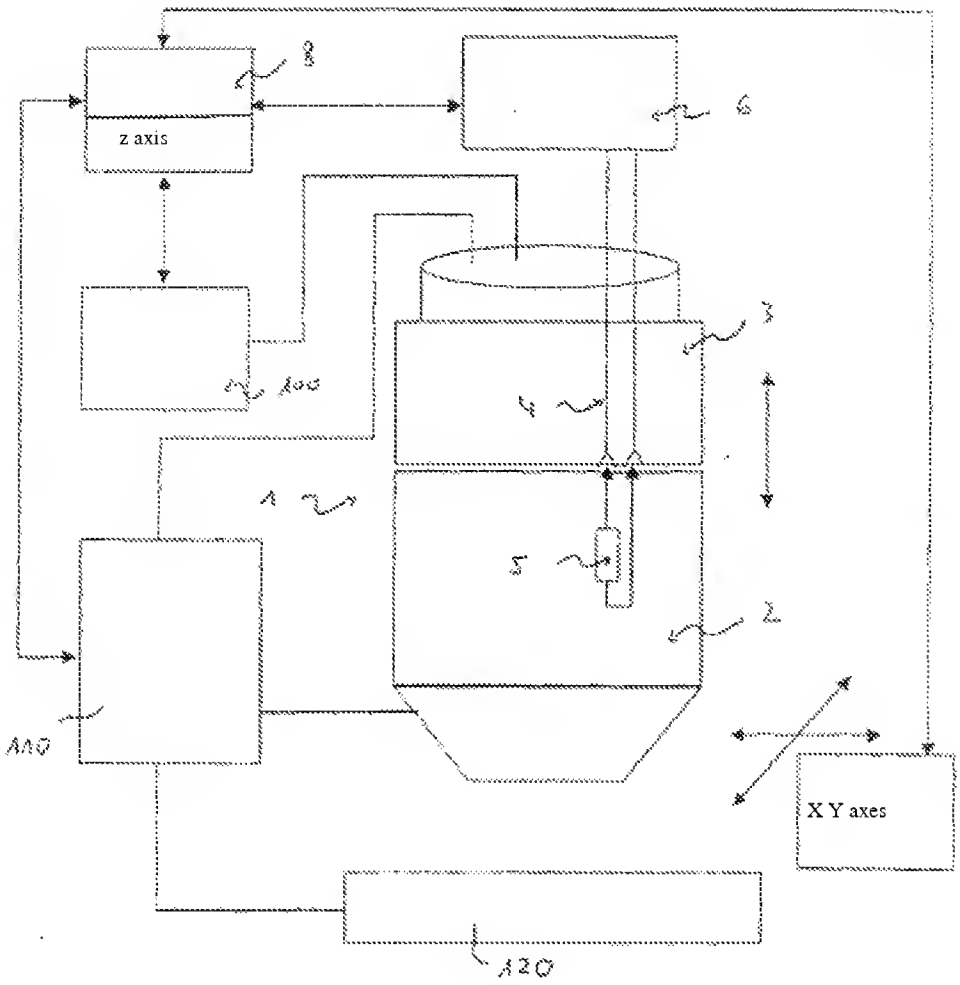
15. Control method according to one of Claims 13 or 14, characterized in that the control of the supply of the torch (1) with electrical current and with fluid comprises at least one of the following steps:

(i) authorizing the supply of the torch (1) with electrical current and with fluid in such a manner that an operation of working with the arc is started, if the comparison made in step (b) shows that the value of the determined specific signal is equal to or close to the reference or nominal value; and

(ii) prohibiting the supply of the torch (1) with electrical current and with fluid in such a manner that the start of an operation of working with the arc is prevented, if the comparison made in step (b) shows that the value of the determined specific signal is different from the reference or nominal value.

16. Method for plasma cutting at least one metal part, in which one uses a plasma cutting torch according to one of Claims 1-3 and/or in which one uses a control method according to one of Claims 13-15 to control a plasma cutting torch.

FIG.1



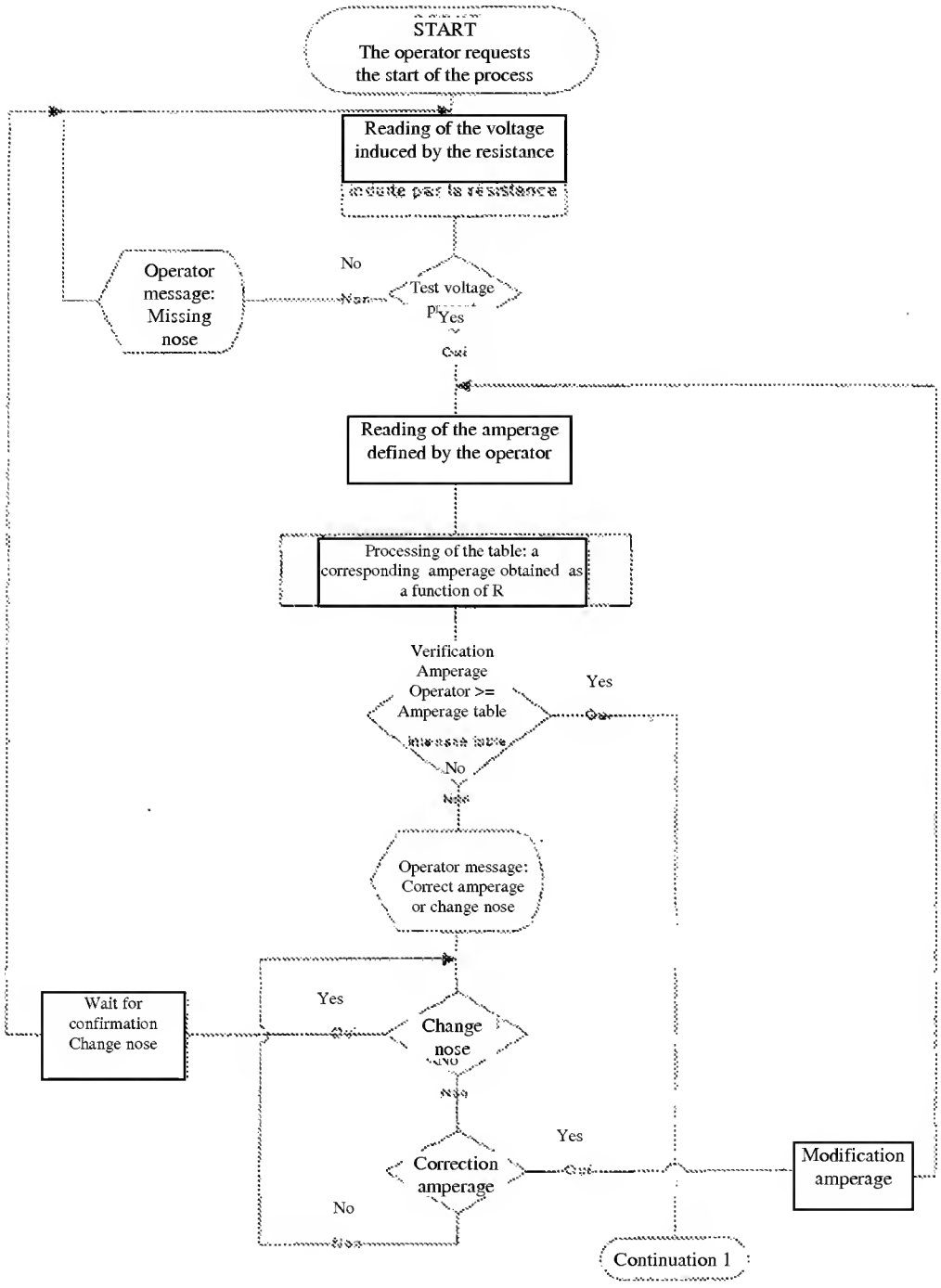

START
The operator requests the start of the process
Reading of the voltage induced by the resistance
Test voltage
No
Yes
Operator message: Missing nose
Reading of the amperage defined by the operator
Processing of the table: a corresponding amperage obtained as a function of R
Verification Amperage Operator >= Amperage table
Yes
No
Operator message: Correct amperage or change nose
Wait for confirmation Change nose
Yes
Change nose
Correction amperage
Yes
No
Modification amperage
Continuation 1

FIG.2

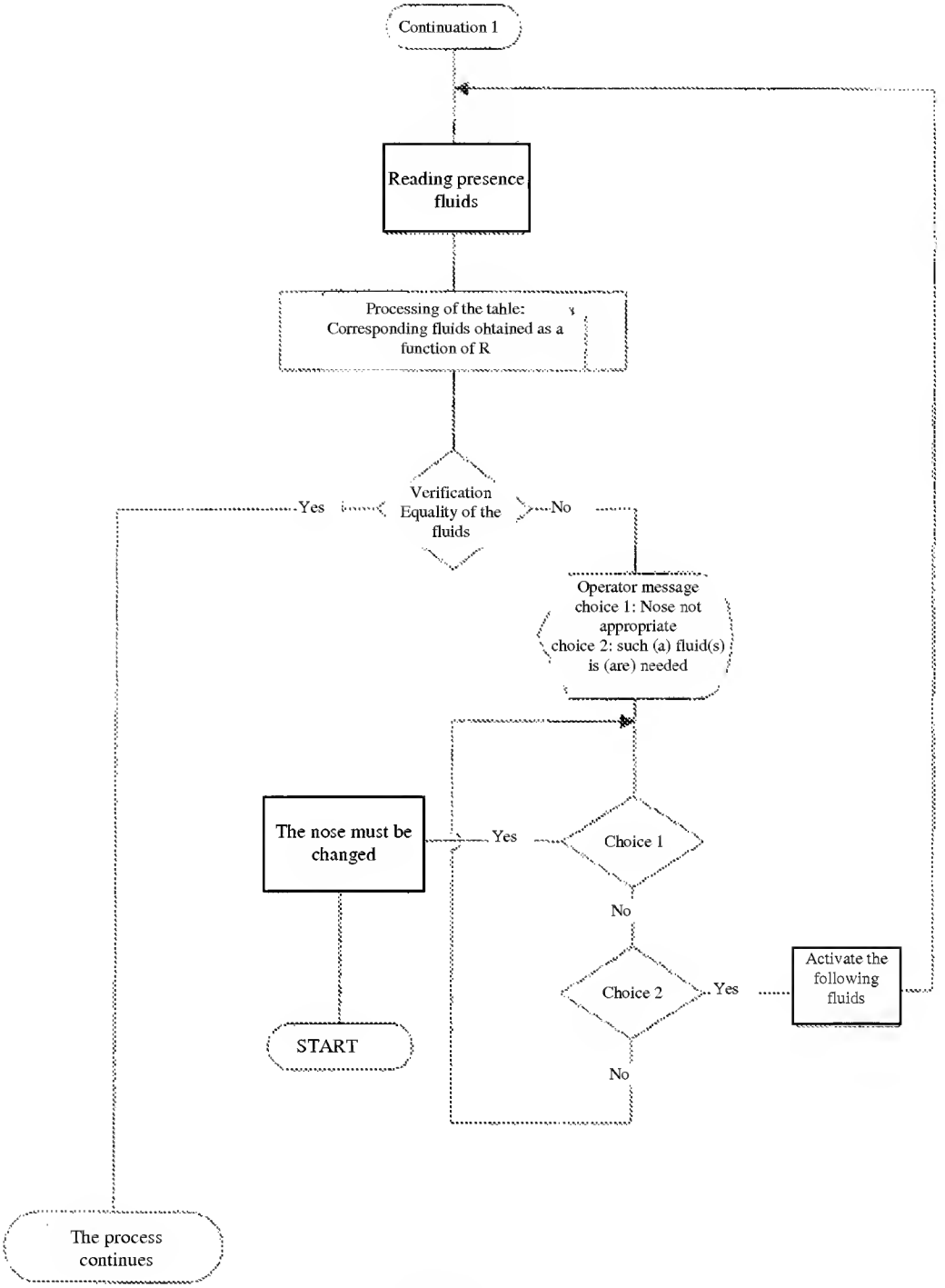

Continuation 1
Reading presence fluids
Processing of the table: Corresponding fluids obtained as a function of R
Verification Equality of the fluids
Yes
No
Operator message choice 1: Nose not appropriate choice 2: such (a) fluid(s) is (are) needed
The nose must be changed
Yes
Choice 1
No
Choice 2
Yes
Activate the following fluids
No
START
The process continues

FIG.3

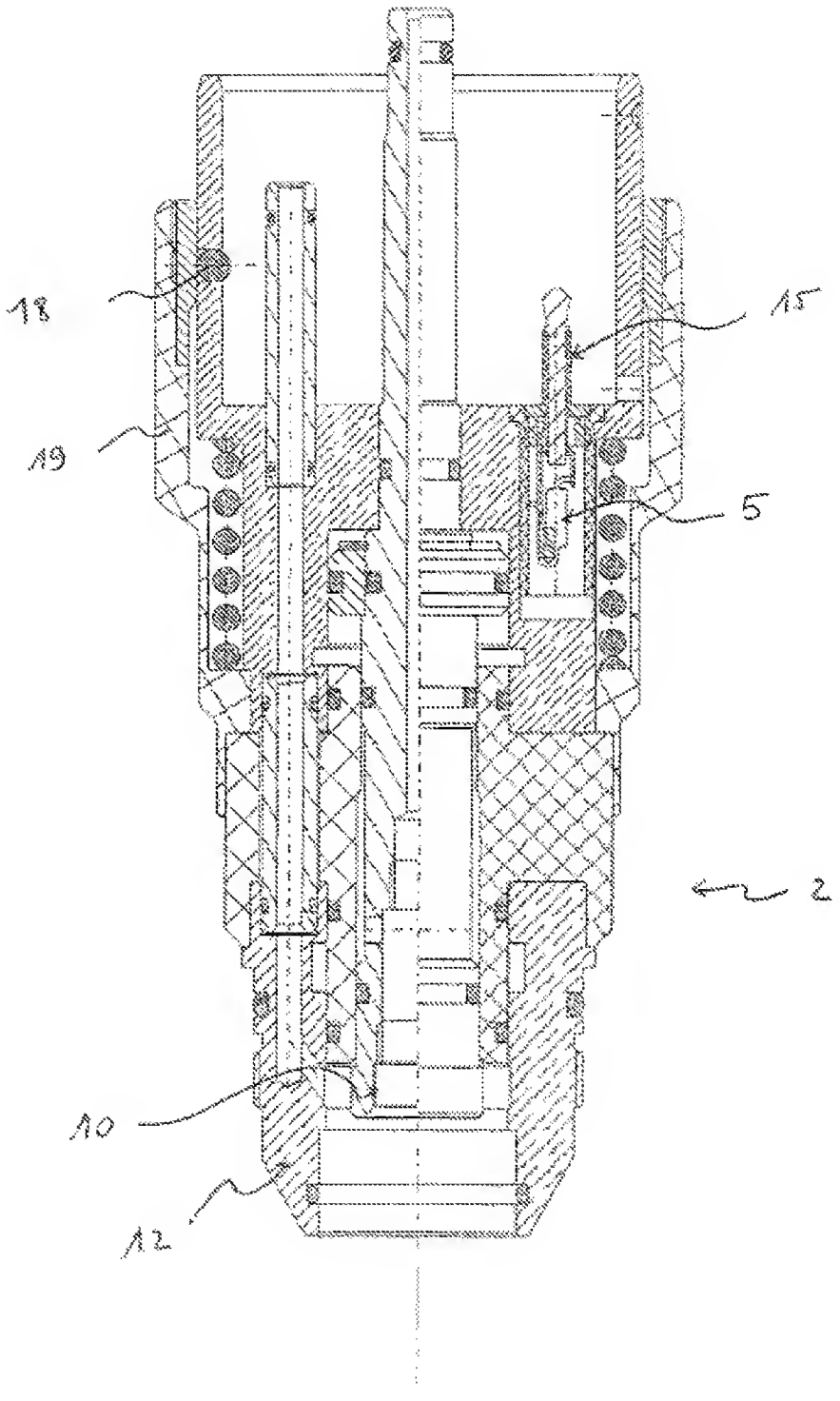


FIG.4

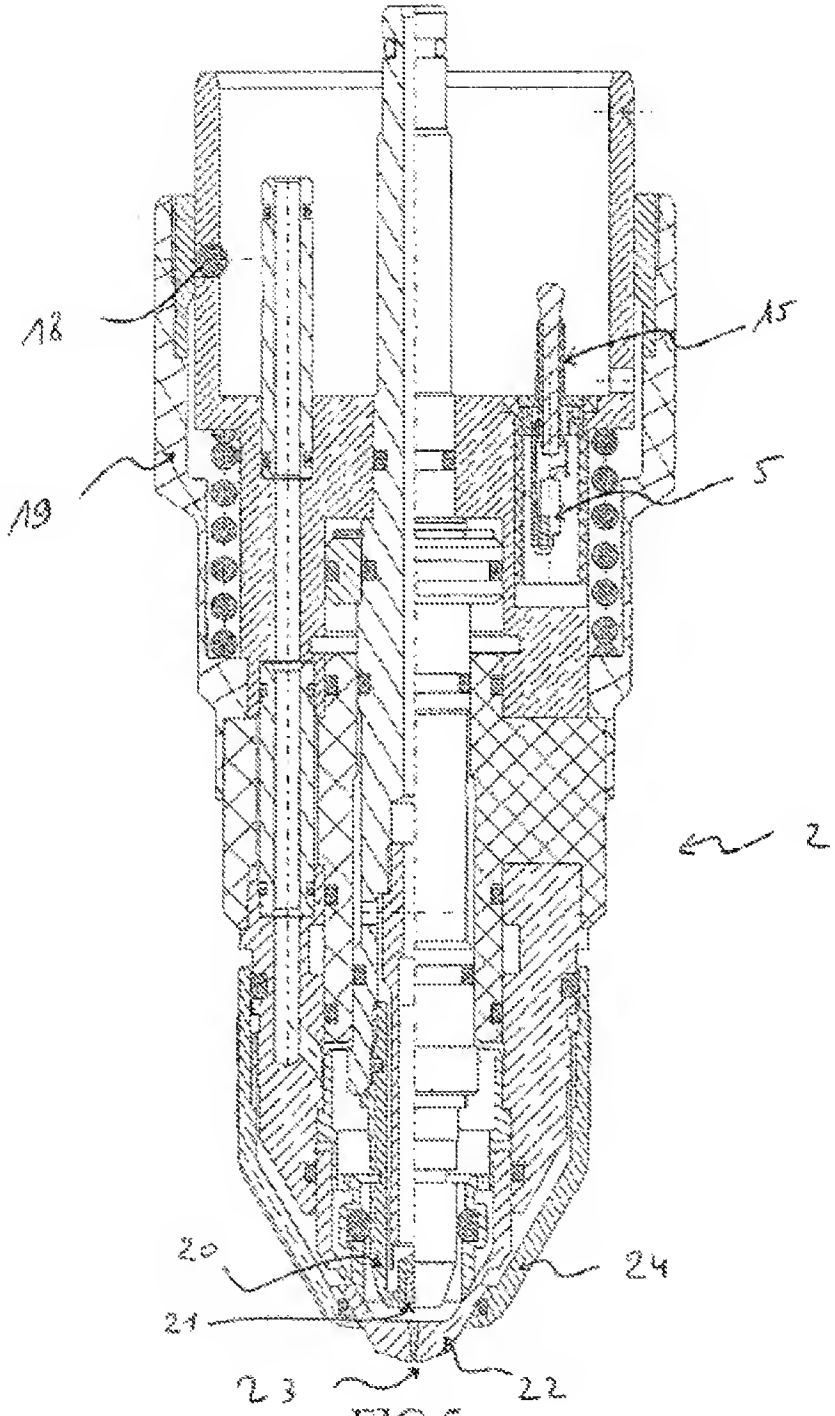


FIG.5

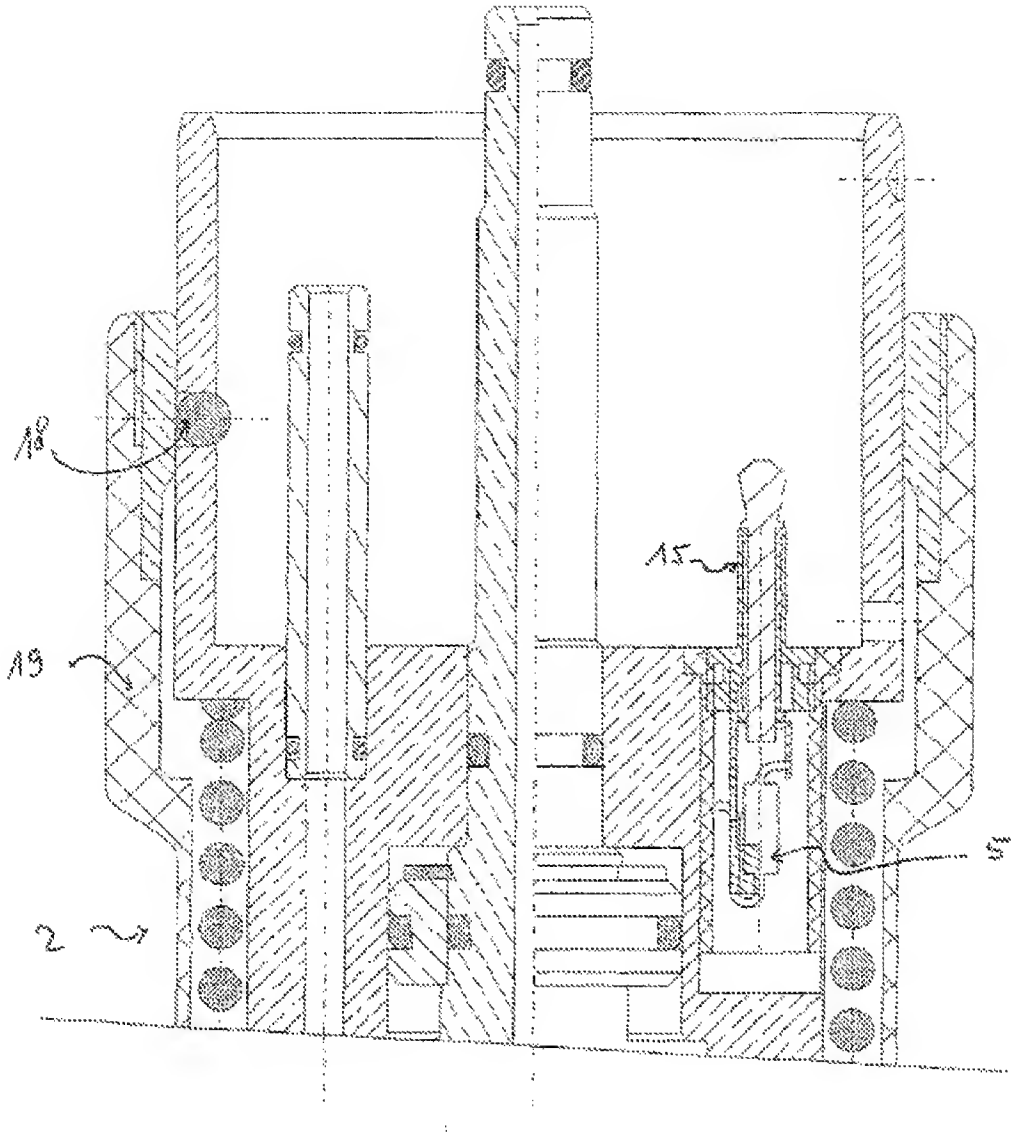


FIG.6

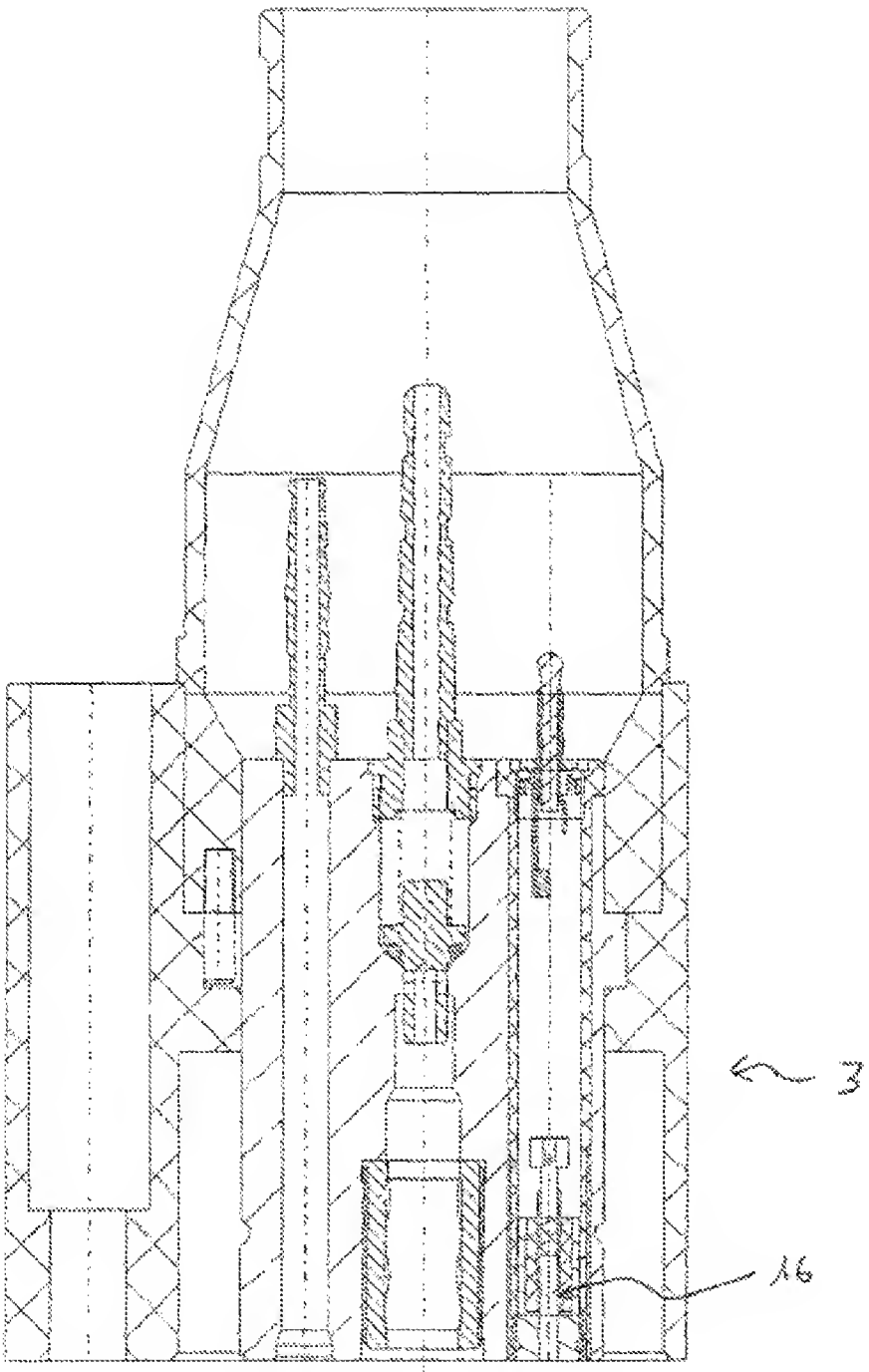


FIG.7

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.7)
Y	EP 0 508 482 A (LINCOLN ELECTRIC CO) October 14, 1992 (1992-10-14) * column 2, line 54 – column 4, line 11 * ---	1,4-6, 13,14,16	H05H1/36
D,Y	EP 0 599 709 1994-06-01) * claim 1; figure 1 * ---	1,4-6, 13,14,16	
A	WO 87 01798 A (SOUDURE AUTOGENE FRANCAISE) June 1, 1994 ((RENISHAW PLC) March 26, 1987 (1987-03-26) * page 2, line 19 – line 31 * * page 4, line 1 – page 7, line 10 * * figure 1 * ---	1-6,8, 10-15	
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 227 (M-505). August 7, 1986 (1986-08-07) & JP 61 063368 A (TAKASHI MURATA), April 1, 1986 (1986-04-01) * abstract * ---	2	TECHNICAL FIELDS SEARCHED (Int. Cl.7) H05H
A	WO 96 21339 A (HYPERTHERM INC) July 11, 1996 (1996-07-11) * page 3, line 24 – page 4, line 4 * * page 10, line 8 – line 14 * * figure 3B * ---	1,5-7, 10-12,14	
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The present search report has been drawn up for all claims.			

Place of search	Date of completion of the search	Examiner
THE HAGUE	April 17, 2001	Capostagno, E

CATEGORY OF CITED DOCUMENTS

X: Particularly relevant if taken alone.
Y: Particularly relevant if combined with another document of the same category.
A: Technological background.
O: Non-written disclosure.
P: Intermediate document.

T: Theory or principle underlying the invention.
E: Earlier patent document, but published on, or after the filing date.
D: Document cited in the application.
L: Document cited for other reasons.

.....

&: Member of the same patent family, corresponding document.

APPENDIX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 40 0063

In this appendix, the patent family members of patent documents listed in the above-referenced European Search Report are indicated.

The data on the family members correspond to the state of the files of the European Patent Office on April 17, 2001

These data serve only for information and do not engage the responsibility of the European Patent Office

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For additional details regarding this Appendix: see Official Journal of the European Patent Office No. 12/82